CLAIMS

[00159] What is claimed is:

1. A method comprising:
modifying a free-running frequency of at least one of a first slave oscillator, a second slave oscillator and a master oscillator, based on comparing between a phase of an output of the first slave oscillator and a phase of an output of the second slave oscillator.

2. The method of claim 1, wherein modifying the free-running frequency comprises increasing the free-running frequency if the difference between the phase of the output of the first slave oscillator and the phase of the output of the second slave oscillator is smaller than $\pi/2$ radians.

3. The method of claim 1, wherein modifying the free-running frequency comprises decreasing the free-running frequency if the difference between the phase of the output of the first slave oscillator and the phase of the output of the second slave oscillator is larger than $\pi/2$ radians.

4. The method of claim 1, wherein modifying the free-running frequency comprises substantially continuously modifying the free-running frequency.

5. The method of claim 1, wherein modifying the free-running frequency comprises modifying the free-running frequency until an oscillation frequency of the first slave oscillator is locked to an oscillation frequency of the master oscillator.

6. The method of claim 1, wherein comparing said phases comprises differentially comparing a phase of an output of the first slave oscillator to a phase of an output of the second slave oscillator.

7. The method of claim 1, wherein comparing said phases comprises digitally comparing a phase of an output of the first slave oscillator to a phase of an output of the second slave oscillator.

8. The method of claim 1, comprising producing a control signal responsive to a phase difference between the output of the first slave oscillator and the output of the second slave oscillator.

9. The method of claim 8, comprising filtering the control signal.

10. The method of claim 1, wherein modifying the free-running frequency comprises modifying a voltage supplied to said at least one of a first slave oscillator, a second slave oscillator and a master oscillator.

11. A method comprising:
modifying a free-running frequency of at least one of a first slave oscillator, a second slave oscillator and a master oscillator, based on comparing between a value responsive to a phase of an output of the first slave oscillator and a value responsive to a phase of an input from the master oscillator.

12. The method of claim 11, wherein modifying the free-running frequency comprises increasing the free-running frequency if the difference between the phase of the output of the first slave oscillator and the phase of the input from the master oscillator is smaller than $\pi/2$ radians.

13. The method of claim 11, wherein modifying the free-running frequency comprises decreasing the free-running frequency if the difference between the phase of the output of the first slave oscillator and the phase of the input from the master oscillator is larger than $\pi/2$ radians.

14. The method of claim 11, wherein modifying the free-running frequency comprises substantially continuously modifying the free-running frequency.

15. The method of claim 11, wherein modifying the free-running frequency comprises modifying the free-running frequency until the free-running frequency of the first slave oscillator is substantially equal to the frequency of the input from the master oscillator.

16. The method of claim 11, wherein comparing said phases comprises differentially comparing a phase of an output of the first slave oscillator to a phase of the input from the master oscillator.

17. The method of claim 11, wherein comparing said phases comprises digitally comparing a phase of an output of the first slave oscillator to a phase of the input from the master oscillator.

18. The method of claim 11, wherein comparing said phases comprises:
dividing the output of the first slave oscillator by a pre-determined factor to provide a first divided signal;
dividing the input from the master oscillator by twice the pre-determined factor to provide a second divided signal; and
comparing between the first and second divided signals.

19. The method of claim 11, wherein modifying the free-running frequency comprises digitally comparing a phase of an output of the first slave oscillator to a phase of the input from the master oscillator.

20. The method of claim 11, wherein modifying the free-running frequency comprises producing a control signal responsive to a phase difference between the output of the first slave oscillator and the input from the master oscillator.

21. The method of claim 20, comprising filtering the control signal.

22. The method of claim 11, wherein modifying the free-running frequency comprises modifying a voltage supplied to said at least one of a first slave oscillator, a second slave oscillator and a master oscillator.

23. An apparatus comprising:
a tuning circuit to tune a free-running frequency of at least one of a first slave oscillator, a second slave oscillator and a master oscillator, based on a comparison between a phase of an output of the first slave oscillator and a phase of an output of the second slave oscillator.

24. The apparatus of claim 23, comprising:
a gate to produce an output signal responsive to said comparison; and
a subtractor to subtract the voltage of said output signal from a reference voltage and to produce a control signal.

25. The apparatus of claim 24, comprising a loop filter to filter said control signal based on a pre-defined criterion.

26. The apparatus of claim 23, comprising:
a first gate to produce a first output signal responsive to the phase-difference between the output of the first slave oscillator and the output of the second slave oscillator;
a second gate to produce a second output signal responsive to the phase-difference between the output of the first slave oscillator and a complementary component of the output of the second slave oscillator; and
a subtractor to subtract the voltage of the first output signal from the voltage of the second output signal and to produce a control signal.

27. The apparatus of claim 23, comprising:
a first gate to produce a first control signal responsive to the phase-difference between the output of the first slave oscillator and the output of the second slave oscillator;

a second gate to produce a second control signal responsive to the phase-difference between the output of the first slave oscillator and a complementary component of the output of the second slave oscillator.

28. An apparatus comprising:
a tuning circuit to tune a free-running frequency of at least one of a first slave oscillator, a second slave oscillator and a master oscillator, based on a comparison between a value responsive to a phase of an output of the first slave oscillator and a value responsive to a phase of an input from the master oscillator.

29. The apparatus of claim 28, comprising:
a first gate to produce a first output signal responsive to the phase-difference between the output of the first slave oscillator and the input from the master oscillator;
a second gate to produce a second output signal responsive to the phase-difference between the output of the second slave oscillator and the input from the master oscillator; and
a subtractor to subtract the voltage of said first output signal from said second output signal and to produce a control signal.

30. The apparatus of claim 29, comprising a loop filter to filter said control signal based on a pre-defined criterion.

31. The apparatus of claim 28, comprising
a first gate to produce a first output signal responsive to the phase-difference between the output of the first slave oscillator and the input from the master oscillator; and
a second gate to produce a second output signal responsive to the phase-difference between the output of the first gate and the output of the second slave oscillator and to produce a control signal.

32. The apparatus of claim 31, comprising a scaling circuitry to scale an amplitude of said control signal.

33. The apparatus of claim 28, comprising:
a first gate to produce a first control signal responsive to the phase-difference between the output of the first slave oscillator and the injection input; and
a second gate to produce a second control signal responsive to the phase-difference between the output of the second slave oscillator and the injection input.

34. The apparatus of claim 28, comprising:
a first divider to divide the frequency of an output of the first slave oscillator by a pre-determined factor and to produce a first divided signal;
a second divider to divide the frequency of the input from the master oscillator by substantially twice the pre-determined factor and to produce a second divided signal; and
a detector to produce a control signal based on the phase-difference of the first divided signal and the second divided signal.

35. A wireless communication device comprising:
a dipole antenna to send and receive wireless signals; and
a tuning circuit to tune a free-running frequency of at least one of a first slave oscillator, a second slave oscillator and a master oscillator, based on a comparison between a phase of an output of the first slave oscillator and a phase of an output of the second slave oscillator.

36. The wireless communication device of claim 35, wherein the tuning circuit comprises:
a gate to produce an output signal responsive to said comparison; and
a subtractor to subtract the voltage of said output signal from a reference voltage and to produce a control signal.

37. The wireless communication device of claim 35, wherein the tuning circuit comprises:
a first gate to produce a first output signal responsive to the phase-difference between the output of the first slave oscillator and the output of the second slave oscillator;
a second gate to produce a second output signal responsive to the phase-difference between the output of the first slave oscillator and a complementary component of the output of the second slave oscillator; and

a subtractor to subtract the voltage of the first output signal from the voltage of the second output signal and to produce a control signal.

38. The wireless communication device of claim 35, wherein the tuning circuit comprises:
a first gate to produce a first control signal responsive to the phase-difference between the output of the first slave oscillator and the output of the second slave oscillator;
a second gate to produce a second control signal responsive to the phase-difference between the output of the first slave oscillator and a complementary component of the output of the second slave oscillator.

39. A wireless communication device comprising:
a dipole antenna to send and receive wireless signals; and
a tuning circuit to tune a free-running frequency of at least one of a first slave oscillator, a second slave oscillator and a master oscillator, based on a comparison between a value responsive to a phase of an output of the first slave oscillator and a value responsive to a phase of an input from the master oscillator.

40. The wireless communication device of claim 39, wherein the tuning circuit comprises:
a first gate to produce a first output signal responsive to the phase-difference between the output of the first slave oscillator and the input from the master oscillator;
a second gate to produce a second output signal responsive to the phase-difference between the output of the second slave oscillator and the input from the master oscillator; and
a subtractor to subtract the voltage of said first output signal from said second output signal and to produce a control signal.

41. The wireless communication device of claim 39, wherein the tuning circuit comprises:
a first gate to produce a first output signal responsive to the phase-difference between the output of the first slave oscillator and the input from the master oscillator; and
a second gate to produce a second output signal responsive to the phase-difference between the output of the first gate and the output of the second slave oscillator and to produce a control signal.

42. The wireless communication device of claim 39, wherein the tuning circuit comprises:
a first divider to divide the frequency of an output of the first slave oscillator by a pre-determined factor and to produce a first divided signal;
a second divider to divide the frequency of the input from the master oscillator by substantially twice the pre-determined factor and to produce a second divided signal; and
a detector to produce a control signal based on the phase-difference of the first divided signal and the second divided signal.

43. A communication system comprising:
a first communication device able to communicate with a second communication device over a communication channel, the first communication device comprising:
a dipole antenna to send and receive wireless signals; and
a tuning circuit to tune a free-running frequency of either or both of a first oscillator and a second oscillator based on a comparison between a phase of an output of the first oscillator and a phase of an output of the second oscillator.

44. The communication system of claim 43, wherein said first oscillator comprises a slave oscillator and wherein said second oscillator comprises a master oscillator.

45. The communication system of claim 43, wherein said first oscillator comprises a first slave oscillator and wherein said second oscillator comprises a second slave oscillator.